PB-245 800

INVESTIGATION OF THE EFFECTS OF THE WASTE DISCHARGES FROM THE GREAT WESTERN SUGAR MILL AT OVID, COLORADO ON WATER QUALITY CONDITIONS IN THE SOUTH PLATTE RIVER

National Field Investigations Center
Denver, Colorado

1972

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE

302226

PB 245 800

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
US Department of Commerce
Springfield, VA. 22151

BIBLIOGRAPHIC DATA SHEET	1. Report No.	2.	3. Recipient's Accession No.
4. Title and Subtitle Investigations of the Effects of the Waste discharges from the Great Western Sugar Mill at Ovid, Colorado on water quality conditions in the South Platte River.			5. Report Date 1972
			6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address National Field Investigations Center Denver, Colorado			10. Project/Task/Work Unit No.
			11. Contract/Grant No.
12. Sponsoring Organization Name and Address ~~Region~~ Environmental Protection Agency Region VIII Denver Colorado.			13. Type of Report & Period Covered
			14.

15. Supplementary Notes

16. Abstracts Investigations of the water quality in reach of the South Platte River affected by the sugar mill waste discharges were conducted in order to define conditions prior to and during the sugar-beet processing season. Waste sources were also evaluated. Observed water quality conditions are compared to applicable water quality regulations. Violations of water quality standards are defined. Remedial measures to abate existing interstate pollution that is in violation of water quality standards are recommended.

17. Key Words and Document Analysis. 17a. Descriptors

* Water quality
* Water pollution
* Stream pollution
* Abatement

17b. Identifiers/Open-Ended Terms

* South Platte River.
* Waste discharges
* Waste sources

17c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Release unlimited	UNCLASSIFIED	26
	20. Security Class (This Page) UNCLASSIFIED	22. Price

ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT

EFFECTS OF WASTE DISCHARGES FROM THE GREAT WESTERN SUGAR MILL AT OVID, COLORADO ON WATER QUALITY CONDITIONS IN THE SOUTH PLATTE RIVER

National Field Investigations Center - Denver
Denver, Colorado
and

Region VII
Kansas City, Missouri

Region VIII
Denver, Colorado

TABLE OF CONTENTS

Title	Page
GLOSSARY OF TERMS	ii
LIST OF TABLES	iii
LIST OF FIGURES	iii
I. INTRODUCTION	1
II. SUMMARY AND CONCLUSIONS	2
III. RECOMMENDATIONS	4
IV. APPLICABLE WATER QUALITY REQUIREMENTS	5
A. Water Quality Standards	5
B. Enforcement Conference Requirements	6
First Session	6
Second Session	7
Reconvened Second Session	7
V. WASTE SOURCES	9
A. Great Western Sugar Company Mill at Ovid	9
B. Ovid Wastewater Treatment Plant	12
C. Julesburg Wastewater Treatment Plant	12
VI. STREAM SURVEYS	15
A. September 27-29, 1971	15
B. November 29-December 3, 1971	18
C. Low Flow Conditions	20
REFERENCES	21
APPENDIX A - COLORADO WATER QUALITY STANDARDS	
APPENDIX B - NEBRASKA WATER QUALITY STANDARDS FOR THE PROTECTION OF CLASS "C" WATERS	
APPENDIX C - WATER QUALITY OBJECTIVES RECOMMENDED TO THE CONFERENCE AS A RESULT OF STUDIES CONDUCTED BY THE SOUTH PLATTE RIVER BASIN PROJECT	

GLOSSARY OF TERMS

BOD - Biochemical Oxygen Demand, 5-Day

COD - Chemical Oxygen Demand

DO - Dissolved Oxygen

TOC - Total Organic Carbon

SS - Suspended Solids

RM - river mileage

cfs - flow rate given in cubic feet per second

gpm - flow rate given in gallons per minute

mgd - flow rate given in million gallons per day

mg/l - concentration given in milligrams per liter

µmhos/cm - unit of specific conductance (mho -- the inverse of the standard unit of electrical resistance, the ohm) measured over a 1-centimeter distance, conventionally made at 25°C.

LIST OF TABLES

Table No.	Title	Page
1	Results of Bacteriological Analyses - South Platte River (SPR) from Ovid, (Colorado) Downstream to the I-80 Highway Bridge (Nebraska) (November 29-December 3, 1971)	10
2	Summary of Field Measurements and Analytical Results - South Platte River (SPR) from Ovid (Colorado) Downstream to the I-80 Bridge (Nebraska) (November 29-December 3, 1971)	13
3	Results of Bacteriological Analyses - South Platte River (SPR) from Ovid (Colorado) Downstream to the I-80 Highway Bridge (Nebraska) (September 27-29, 1971)	16
4	Seven-Day Flow Periods for Each Year	20

LIST OF FIGURES

Figure No.	Title	Follows Page
1	Location Map Water Quality Investigations in the South Platte River Ovid, Colorado	15

I. INTRODUCTION

The Great Western Sugar Company (subsidiary of the Great Western United Corporation) operates a sugar-beet processing mill at Ovid, Colorado, on the South Platte River near the Colorado-Nebraska state line. Inadequately treated industrial wastes from this mill are discharged to the River about 11 miles upstream from Nebraska. Small volumes of municipal wastes from the Colorado communities of Ovid and Julesburg are also discharged to this reach of the river.

Investigations of the water quality in the reach of the South Platte River affected by the sugar mill waste discharges were conducted, by the National Field Investigations Center-Denver of the Environmental Protection Agency (EPA) from September to December 1971, in order to define conditions prior to and during the sugar-beet processing season. Waste sources were also evaluated.

This report summarizes the results of these investigations. Observed water quality conditions are compared to applicable water quality regulations. Violations of water quality standards are defined. A comparison is also made to water quality conditions existing in 1963. Remedial measures to abate existing interstate pollution that is in violation of water quality standards are recommended.

II. SUMMARY AND CONCLUSIONS

Although there has been a reduction in the waste loads discharged from the Great Western Sugar Company mill at Ovid, adequate waste treatment is not being provided. The compliance date set at the Enforcement Conference for meeting the water quality standards has not been achieved.

The coliform bacteria densities in the South Platte River, downstream from the plant, are similar to those observed in 1963 when the flow conditions were approximately the same. The Colorado and Nebraska Water Quality Standards for bacteria are being violated as a result of the discharge from the Great Western mill at Ovid -- with the log mean fecal- and total-coliform bacteria densities both being 60 times greater than the Nebraska Standards, and the log mean fecal coliform bacteria levels being about 90 times greater than the present Colorado standards at the state line.

During the November-December survey, the Great Western Sugar Company mill at Ovid was discharging into the South Platte River, an average of 10,200 lb of BOD and 3,800 lb of suspended solids per day, thus greatly exceeding the waste loads attainable by the base-level treatment practices for the sugar beet industry (1400 lb/day each of 5-day BOD and suspended solids for present plant operation).

The Great Western mill at Ovid provides marginal primary treatment in its sedimentation ponds -- detention time decreasing as the pond fills up with solids. Requirements of the State of Colorado that wastewaters

receive a minimum of secondary treatment with 80 percent removal of BOD plus disinfection were not being met. A higher degree of treatment should be required if necessary to protect designated uses listed in approved State-Federal water quality standards.

In view of the observed low flows that have occurred during the past ten years it is clear that the discharges from the Great Western Sugar Company mill at Ovid have caused serious recurring water quality problems in the receiving waters. In the absence of satisfactory treatment unacceptable conditions may be expected to recur during each sugar-beet processing season. Reduction of discharge waste loads to levels attainable with base-level treatment (0.5 lb each of 5-day BOD and suspended solids per ton of beets processed) could be expected to provide adequate protection of the receiving waters.

Municipal waste discharges from the Ovid and Julesburg treatment plants contributed insignificant waste loads and bacterial populations: however, on October 6, 1971, the latter facility was not operating at the efficiency required by the Colorado Water Pollution Control Commission.

In addition to violations of established standards, the water quality objectives recommended by the South Platte River Basin Project were not being met [Appendix C]. The biological studies indicated that algal and slime growths occurred in the South Platte River downstream from Ovid as a result of waste discharged by the Great Western mill. Violations of Sections B & D of the Basic Standards Applicable to all Waters of the State were occurring.

III. RECOMMENDATIONS

In order to achieve early abatement of pollution of the interstate waters of the South Platte River caused by discharges of inadequately treated industrial wastes from the Great Western sugar-beet processing mill at Ovid, Colorado (owned and operated by the Great Western Sugar Company, subsidiary of the Great Western United Corporation), it is recommended that:

1. The Great Western Sugar Company develop a schedule for implementation of necessary waste treatment facilities and practices at its Ovid mill to provide adequate treatment of all wastes discharged during the 1972-73 sugar beet processing campaign. This implementation schedule should be submitted to the Environmental Protection Agency for approval within 60 days of the 180-day Notice Hearing.

2. Condenser and transport waters be separated; transport and general plant wastes be completely recycled and re-used.

3. The combined waste discharges from the Great Western mill at Ovid contain not greater than 0.5 lb each of BOD and suspended solids/ton of beets sliced with the total load of each not to exceed 1,400 lb/day, whichever is less.

4. The number of fecal coliform organisms in the combined discharges not exceed 75×10^6 organisms per ton of beets or a density of 1,000/100 ml, whichever is less.

IV. APPLICABLE WATER QUALITY REQUIREMENTS

A. WATER QUALITY STANDARDS

Water quality standards applicable to the South Platte River and its tributaries in Colorado were established in June 1967 by the Colorado Water Pollution Control Commission -- in accordance with provisions of the Federal Water Pollution Control Act, as amended.[1/] These standards were subsequently revised and fully approved as Federal standards. They consist of three components: 1) Stream classifications that designate water uses to be protected; 2) Water quality criteria that specify water quality conditions which must be maintained; 3) An implementation plan that establishes time schedules for providing adequate treatment or control facilities for all sources of pollution.

Colorado classified the South Platte River from the Denver area downstream to the Nebraska state line for industrial and agricultural wate. uses (Class C and D). In order to achieve compatability with Nebraska water quality standards, Colorado classified the River at the Nebraska State Line as a warm-water fishery (Class B-2) and for irrigation (Class D-1). [Water quality criteria applicable to these classifications are summarized in Appendix A.] An implementation schedule was established that required the Ovid sugar-beet processing mill to be in compliance with the water quality standards by December 31, 1968.

Water quality standards applicable to the South Platte River were also established by Nebraska in June 1967. These standards were subsequently revised and fully approved as Federal standards. Nebraska classified the South Platte River downstream from the Colorado state line for

agricultural and industrial uses, partial body contact sports, and for fish and wildlife (Class C). [Applicable water quality criteria are summarized in Appendix B.]

B. ENFORCEMENT CONFERENCE REQUIREMENTS

First Session

In 1963, the First Session of the *Conference in the Matter of Pollution of the South Platte River Basin* in the State of Colorado was called, under provisions of the Federal Water Pollution Control Act, by the U. S. Department of Health, Education, and Welfare at the request of Colorado Governor, John Love. The Session reviewed existing water pollution and pollution-abatement practices in the South Platte River Basin and formulated objectives calling for studies to develop plans for the control and abatement of water pollution therein. To carry out the objectives laid down by the First Session, a South Platte River Basin Project was established. A study, to be conducted jointly with the State of Colorado, was undertaken to determine legitimate water uses and locate the sources of pollution having an adverse effect on those uses; through field investigations to determine the physical, chemical, and biological responses of the South Platte River to pollution and to evaluate the previously located sources of pollution with respect to the conditions in the River; and to compute the waste-load reductions necessary to obtain desired water quality and to recommend the water quality control measures needed to effect the desired-waste load reductions.

Second Session

The Second Session of the *Conference*, held in April 1966, was largely devoted to presentation of the results of the Project's studies, including water quality objectives that were recommended for the South Platte River and waste treatment requirements for the Ovid sugar beet mill [Appendix C]. These recommendations called for a high level of waste-load reduction to be achieved by the Ovid mill by September 30, 1968.

The *Conference* adjourned without formulating specific pollution abatement recommendations in order to allow the new Colorado Water Pollution Control Commission sufficient time to study and evaluate the Project's report and to develop a program for implementation of remedial measures as well as a time schedule.

Reconvened Second Session

At the reconvening of the Second Session of the *Conference in the Matter of Pollution of the South Platte River Basin* in November 1966, the Conferees recommended that the final compliance date for providing adequate treatment of all waste discharges in the Basin be extended from the Project's recommended date of September 30, 1968, to June 30, 1971.

> "All discharges into the South Platte River Basin shall have adequate remedial or control facilities in full operation by June 30, 1971, so as to comply with water quality standards established by the Colorado Water Pollution Control Commission as approved by the Secretary of the Interior."[2/]

The Conferees did not specifically adopt the water quality objectives or waste treatment requirements recommended by the Project although a number of these recommendations were subsequently incorporated in the Colorado Water Quality Standards.

V. WASTE SOURCES

A. GREAT WESTERN SUGAR COMPANY MILL AT OVID

This mill processes approximately 2,800 tons of beets per day. The wastewaters (after screening) are discharged to two settling ponds (approximately 750 ft by 75 ft). Only one pond is used at a time; when it has filled with solids, the other pond is used. The detention time is short -- a matter of several hours depending upon the level of solids buildup in the ponds. The observed discharge during the 3-day sampling period (November 30 - December 3, 1971) averaged 4.9 mgd. The average daily BOD and suspended-solids loads discharged were 10,200 and 3,800 lb, respectively. This corresponds to a waste production of 3.6 lb of BOD and 1.4 lb of suspended solids per ton of beets processed per day. (These values are approximately 700 and 300 percent above the waste loads attainable by base-level treatment methods for the sugar beet industry.)

Bacteriological analysis indicated there were extremely high counts [Table 1] of fecal coliforms and fecal strentococci in the effluent (log or geometric means > 1.9×10^6/100 ml and > 5×10^6/100 ml, respectively).

In 1963 the only wastewater treatment provided at the Great Western mill was impoundment of lime muds. Studies by the South Platte River Basin Project revealed that wastewaters discharged to the South Platte River contained a BOD load of about 35,000 lb/day. Screening was subsequently installed, but the present settling ponds were not constructed until after the 1970-71 sugar-beet processing season.

TABLE 1
RESULTS OF BACTERIOLOGICAL ANALYSES
SOUTH PLATTE RIVER (SPR) FROM OVID (COLORADO) DOWNSTREAM TO I-80 HIGHWAY BRIDGE (NEBRASKA)
(November 29-December 3, 1971)

Station Number	Station Description	Total Coliform Count/100 ml			Fecal Coliform Count/100 ml			Fecal Streptococci Count/100 ml		
		Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum
SP-1	SPR at I-80 bridge downstream Colo-Nebr. state line (Rm 81.1)	1.6×10^6	610,000	370,000	1×10^6	120,000	40,000	>800,000	>150,000	36,000
SP-2	SPR at Julesburg USGS gage downsteam from US 385 flow (RM 86.9)	1.8×10^6	790,000	400,000	210,000	93,000	45,000	>800,000	>150,000	15,000
JULES-1	Effluent from Julesburg Wastewater Treatment Plant (RM 86.6)				310,000	160,000	53,000			
SP-3	SPR downstream Western discharge at Ovid, Colo. (RM 94.0)	2.5×10^6	>1.4×10^6	580,000	910,000	290,000	160,000	>1×10^6	>680,000	110,000

TABLE 1 (Cont.)
RESULTS OF BACTERIOLOGICAL ANALYSES
SOUTH PLATTE RIVER (SPR) FROM OVID (COLORADO) DOWNSTREAM TO I-80 HIGHWAY BRIDGE (NEBRASKA)
(November 29-December 3, 1971)

Station Number	Station Description	Total Coliform Count/100 ml			Fecal Coliform Count/100 ml			Fecal Streptococci Count/100 ml		
		Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum
OVID-1	Effluent from Great Western mill settling pond (RM 94.8)				4.3×10^6	$>1.9 \times 10^6$	>600,000	$>10 \times 10^6$	$>5 \times 10^6$	$>1 \times 10^6$
LD-1	Liddle Ditch at overflow structure downstream of Lodgepole Creek (RM 95.1)	39,000	20,000	27,000	1,400	980	760	5,900	5,900	3,900
SP-4	SPR at Colo. 23 bridge south of Ovid (RM 95.4)	51,000	2,100	190	240	180	70	6,000	2,100	920

B. OVID WASTEWATER TREATMENT PLANT

This facility, an aerated lagoon followed by a polishing pond, should afford good secondary treatment. No evaluation of the Ovid plant was made. Owing to the small volume and location of the effluent, the discharge from the plant is not considered a significant source of pollution in the study reach. The effluent flows to Lodgepole Creek and subsequently to Liddle Ditch. Bacteriological samples and field measurements were made, during the stream surveys, at the overflow structure on Liddle Ditch immediately downstream of the Lodgepole Creek confluence [see Station LD-1, Tables 1 and 2]. The flow at the Liddle Ditch overflow structure was estimated to be 25 cfs.

C. JULESBURG WASTEWATER TREATMENT PLANT

The plant was evaluated during the period October 3-6, 1971. The facility here includes primary sedimentation, a trickling filter, separate sludge digestion, and a polishing lagoon. BOD removal varied from about 40 to 80 percent at an average daily flow of 0.2 mgd. The BOD and suspended-solids loads discharged were approximately 80 to 100 lb/day. During the November 29 - December 3 stream survey, samples of the plant effluent were collected for bacterial analyses and field measurements only [Tables 1 and 2]. During this time the waste flow was estimated at 0.3 mgd. (BOD and suspended-solids loads and bacteria contributions by the Julesburg waste treatment plant are insignificant.)

TABLE 2
SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
SOUTH PLATTE RIVER (SPR) FROM OVID (COLORADO) DOWNSTREAM TO THE I-80 BRIDGE (NEBRASKA)
(November 29-December 3, 1971)

Station Number	Description	Avg Flow (cfs)	pH Range	Cond. Range µmhos/cm	Temp. Range °F	DO Range	BOD mg/l		Solids, mg/l			
									Total		Suspended	
							Range	Avg	Range	Avg	Range	Avg
SP-1	SPR at I-80 (RM 81.1)	a/	8.1	1500-1650	33-36	10.5-11.6	3-5.4	3.5	1560-1690	1610	120-185	150
SP-2	SPR at Julesburg USGS gage (RM 86.9)	330	8.0-8.2	1500-1650	33-37	10.4-11.0	3-5.4	3.9	1300-1600	1500	95-150	120
JULES-1	Effluent from Julesburg wastewater treatment plant (RM 86.6)	0.31 (est)	7.5-7.7	1650-1700	36-39							
SP-3	SPR downstream Great Western discharge at Ovid (RM 94.0)		7.6-8.1	1550-1600	36-39	9.5-10.0	10-23	13	1570-3910		130-200	155
b/ OVID-1	Effluent from Great Western at Ovid (RM 94.8)	7.6	6.3-7.1	1500-1750	81-86		180-290	250	1600-1690	1650	85-98	93

TABLE 2 (Cont.)
SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
SOUTH PLATTE RIVER (SPR) FROM OVID (COLORADO) DOWNSTREAM TO THE I-80 BRIDGE (NEBRASKA)
(November 29-December 3, 1971)

Station Number	Description	Avg Flow (cfs)	pH Range	Cond. Range µmhos/cm	Temp. Range °F	DO Range	BOD mg/l		Solids, mg/l			
									Total		Suspended	
							Range	Avg	Range	Avg	Range	Avg
LD-1	Liddle Ditch at overflow structure downstream Lodgepole Creek (RM 95.1)	25 (est)	7.7-10.8	1500-1550	35-38	10.8-11.2						
SP-4	SPR at Colo. 23 bridge (RM 95.4)	c/	8.0-8.2	1500-1650	33-37	10.8-11.6	2-3	2.7	1570-1670	1620	110-150	106

a/ Flow would be expected to increase between SP-2 and SP-1 at this time of year due to groundwater accretions.
b/ BOD and solids are results of three 24-hr composite samples. All other stations, grab sampled once daily for five days.
c/ Flow is expected to be less than at Julesburg by the amount of groundwater accretion between SP-4 and SP-2 and the Liddle Ditch overflow and Great Western discharge. Studies by the USGS have shown an increase of 1-2 cfs/mile between Sedgwick (upstream at RM 103.0) and Julesburg.

VI. STREAM SURVEYS

A. SEPTEMBER 27-29, 1971

A limited stream survey was conducted during this period in the South Platte River from Ovid (Colorado) to I-80 (in Nebraska) [Figure 1] in order to determine bacterial conditions prior to the Fall 1971 sugar-beet campaign. Flow in the study reach was above normal during the survey owing to heavy precipitation about 10 days prior to the investigation. The flow at the Julesburg USGS gage was as follows:

September 27 - 725 cfs
September 28 - 650 cfs
September 29 - 540 cfs

Irrigation diversions and groundwater accretions cause variations upstream and downstream from Julesburg. For example, the Western Canal (in Nebraska, about one-third the distance between the state line and the intersection of I-80 and the South Platte River) diverted an average of 90 cfs during this September period of investigation. No diversions occurred between Ovid and Julesburg. Thus, it is assumed that the flow was increasing downstream from Ovid -- to near the state line because of the accretions.

The DO levels at all stream stations were 80 to 110 percent saturation (7.4 - 10.4 mg/l) during the sampling carried out in this period. [Results of the bacterial analyses for this period are in Table 3.] Bacterial densities well below the limits specified by the Nebraska and Colorado Water Quality Standards were observed at all stream stations.

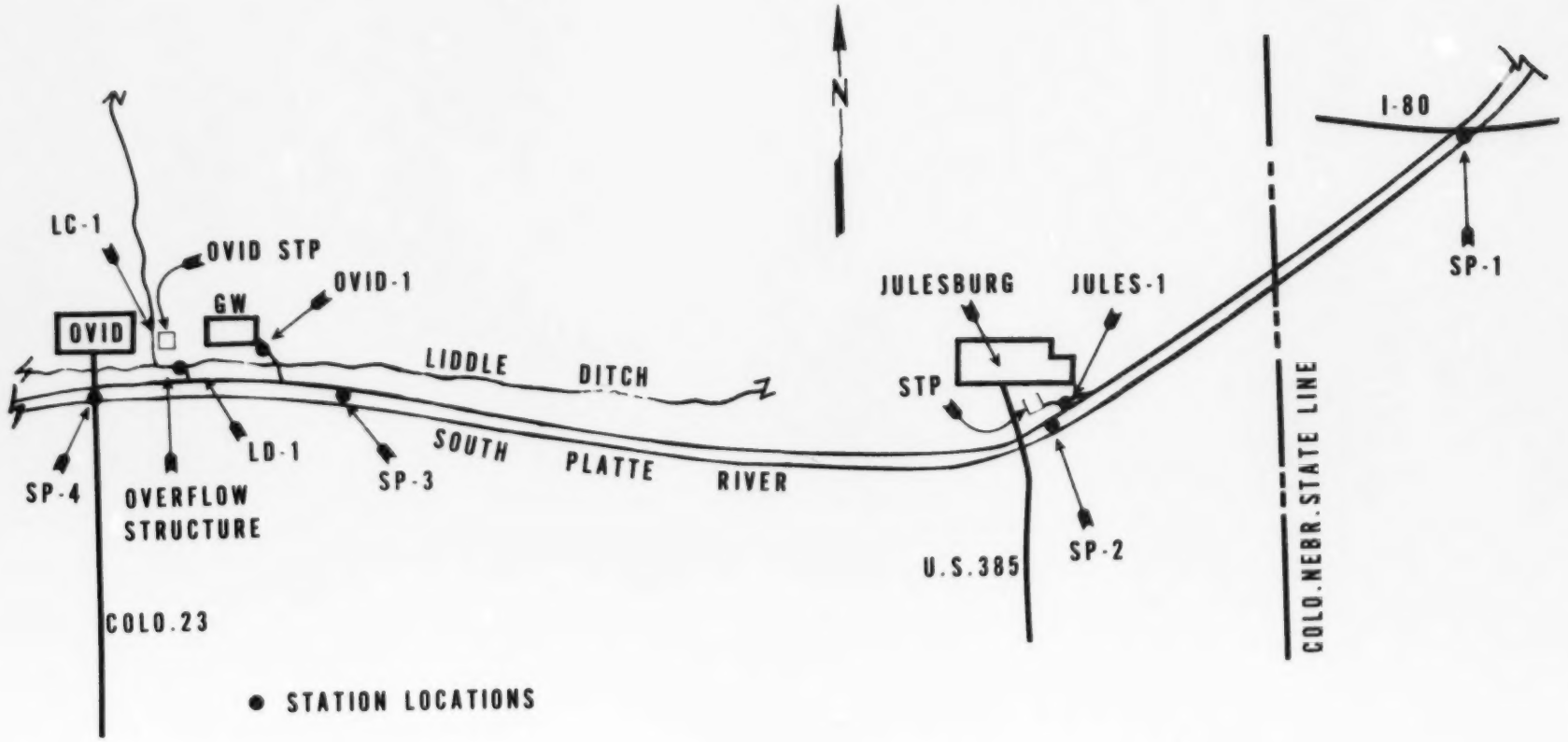

Figure 1 Location Map Water Quality Investigations in the South Platte River Ovid, Colorado.

TABLE 3
RESULTS OF BACTERIOLOGICAL ANALYSES
SOUTH PLATTE RIVER (SPR) FROM OVID (COLORADO) TO THE I-80 BRIDGE (NEBRASKA)
(September 27-29, 1971)

Station Number	Station Description	Total Coliform Count/100 ml			Fecal Coliform Count/100 ml			Fecal Streptococci Count/100 ml		
		Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum
SP-1	SPR at I-80 bridge just below Colo-Nebr. state line (RM 31.1)	2,200[a]	1,500	1,100	530	220	100	3,400	1,500	490
SP-2	SPR at USGS gage downstream of US 385 bridge-Julesburg, Colo. (RM 86.9)	1,300[a]	800[a]	400[a]	520	<80	<10	4,200	1,800	520
JULES-1	Julesburg Wastewater Treatment Plant effluent (RM 86.6)	>800,000	>280,000	>80,000	260,000	33,000	20,000			
LC-1	Lodgepole Creek at U.P.R.R., bridge in Ovid (RM 95.2/0.8)	3,400[a]	1,600[a]	600[a]	500	240	50	4,600	1,800	620

TABLE 3 (Cont.)
RESULTS OF BACTERIOLOGICAL ANALYSES
SOUTH PLATTE RIVER (SPR) FROM OVID (COLORADO) TO THE I-80 BRIDGE (NEBRASKA)
(September 27-29, 1971)

Station Number	Station Description	Total Coliform Count/100 ml			Fecal Coliform Count/100 ml			Fecal Streptococci Count/100 ml		
		Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum
LD-1	Liddle Ditch at diversion structure below mouth of Lodgepole Creek (RM 95.1) (4 samples only)	1,800[a/]	1,300	600[a/]	370	200	110	4,100	1,500	120
SP-4	SPR at highway bridge south of Ovid (RM 95.4)	3,000[a/]	1,800[a/]	1,200[a/]	290	220	170	4,100	1,500	300

a/ Total coliform results estimated because of high background colonies.

B. NOVEMBER 29 - DECEMBER 3, 1971

The study reach was sampled for five consecutive days. Significant inflows were sampled at the same time [Tables 1 and 2]. During this period of the investigation no diversions occurred between Ovid and the I-80 bridge.

Water quality data at the background station (SP-4) indicate both low fecal-coliform bacteria levels and BOD [Figure 1, Tables 1 and 2]. (A survey, conducted by the South Platte River Basin Project during December 1963, also showed low densities of fecal coliform bacteriaa (<300/100 ml) and low levels of BOD (<3 mg/l) at SP-4 during similar flow conditions.) The river was clear and the sand bottom free from sludge deposits. The benchos was limited to eight kinds of organisms because the shifting sand bottom was a poor habitat. However, the benthos community included pollution-sensitive forms, such as caddisflies and mayflies, indicating this reach was free from serious pollution.

Log mean concentrations of fecal coliforms, from samples taken downstream from the discharge of the Great Western mill (SP-3), were more than 1,600 times the log mean values found at SP-4. The instream BOD and suspended-solids levels were increased by the Great Western mill (Ovid) discharge -- with average BOD and suspended solids values at 13 mg/l and 155 mg/l, respectively. (When compared with the BOD values -- consistently above 20 mg/l, observed during the December 1963 survey downstream from Ovid, a slight improvement is evident.) The Great Western mill discharge stimulated algal and slime growth. Blanketing portions of the sandy

stream bed were sludge deposits composed of organic materials. These deposits provide habitat and feed for the sludgeworm-dominated benthic community. Therefore, in this reach violations of Sections B & D of the Basic Standards Applicable to all Waters of the State were occurring.

There was, during this investigation, no significant decrease in the bacterial levels measured at the Julesburg gage (SP-2) from the values found at SP-3. The SP-2 station is upstream of the discharge from the Julesburg wastewater treatment plant and approximately three miles upstream of the Colorado-Nebraska state line. The BOD at SP-2 had decreased to background levels. (Compared with the 1963 survey data, there was an improvement in water quality.) At this station algal and slime growths were reduced.

Data obtained at the I-80 highway bridge (SP-1) indicated the geometric mean fecal coliform densities were 120,000 per 100 ml, or 60 times greater than the Nebraska standards (2,000/100 ml), i.e., a violation of the Nebraska Water Quality Standards for bacteria. Log mean total coliform values were 610,000 per 100 ml, more than 60 times greater than the allowable limit of 10,000/100 ml (log mean). Dense algal growth bordered the stream bed. Benthos numbered more than 5,900/ft^2 of which more than 4,900 were pollution-tolerant sludgeworms.

Observed log or geometric mean fecal-coliform bacteria densities both upstream and downstream from the Colorado-Nebraska state line (SP-1 and SP-2) were more than 90 times greater than the Colorado Standards for bacteria applicable to the South Platte River at the state line. Violations of the Colorado Water Quality Standards were thus also occurring.

C. LOW FLOW CONDITIONS

[Flow data are shown in Table 2 for selected stations during the survey.] The annual processing of sugar beets (often termed a campaign) is normally conducted during the period October 1 through February 1. Because low flows are experienced during at least part of this period and are significant in water quality, NFIC-Denver made an examination of the records in order to compare data and obtain a profile over a 10-year period. Review of the flow records for the USGS station at Julesburg indicates that the average flow during the month of December -- for the years 1961-70 -- was about 360 cfs. The 7-day low flow (during the October-February period) for each year during this 10-year period occurred in the month of October 70 percent of the time.

TABLE 4

SEVEN-DAY FLOW PERIODS FOR EACH YEAR

Water Year	Dates	7-Day Low Flow Oct. 1 - Feb. 1 (cfs)
1961	10/1-10/7	26.7
1962	10/1-10/7	889
1963	10/25-10/31	219
1964	11/1-11/7	126
1965	10/1-10/7	20.5 (10-year, 7-day low flow)
1966	1/21-1/27	447
1967	1/24-1/30	114
1968	10/1-10/7	66
1969	10/1-10/7	113
1970	10/1-10/7	107

REFERENCES

1. *Water Quality Standards for Colorado*, State of Colorado, Department of Health, Water Pollution Control Commission, Denver, Colorado, 1970.

2. *Summary of Reconvened Second Session, Conference in the Matter of Pollution of the South Platte River Basin, Colorado*, U. S. Department of the Interior, Federal Water Pollution Control Administration, November 10, 1966.

APPENDIX A

COLORADO WATER QUALITY STANDARDS

COLORADO WATER QUALITY STANDARDS

Waters of the State, the quality of which exceeds the limits set in these standards, will be maintained at existing quality unless and until it can be demonstrated to the State that a change in quality is justified to provide necessary economic or social development. In that case, the best practicable degree of waste treatment to protect the current classification of such waters will be required. The appropriate Federal authority will be provided with information, from time to time, required to discharge his responsibilities under the Federal Water Pollution Control Act, as amended. (Adopted October 13, 1970.)

I. BASIC STANDARDS APPLICABLE TO ALL WATERS OF THE STATE:

A. All wastes capable of treatment or control prior to discharge into any waters of the State, shall receive secondary treatment with disinfection or its industrial waste equivalent, as determined by the State Water Pollution Control Commission. Lesser degrees of treatment or control may be permitted only where it can be demonstrated that the standards applicable to the classified use of the water can be attained. Greater degrees of treatment or control will be required where it can be demonstrated that it is necessary to comply with the standards applicable to the classified use of the water.

B. Free from substances attributable to municipal, domestic, or industrial wastes, or other controllable sources that will either settle to form unsightly, putrescent, or odorous bottom deposits, or will interfere with the classified use of the water.

C. Free from unsightly floating debris, oil, grease, scum, and other floating material attributable to municipal, domestic, or industrial wastes, or other controllable sources.

D. Free from materials attributable to municipal, domestic or industrial wastes, or other controllable sources that will produce objectionable odor, color, taste, or turbidity in the water, or objectionable aquatic life which may result in eutrophication or other conditions that interfere with the classified use of the water.

E. Free from high temperatures, biocides, toxic, or other deleterious substances attributable to municipal, domestic, or industrial wastes, or other controllable sources in levels, concentrations, or combinations sufficient to be harmful to human or animal life.

F. Radioactive materials attributable to municipal, industrial or other controllable sources will be minimum concentrations that are physically and economically feasible to achieve. In no case shall such materials in the stream exceed the limits established in the current edition of the U. S. Public Health Service Drinking Water Standards or the limits approved by the Federal Radiation Council, or, in the absence of any limits specified by the U. S. Public Health Service or the Federal Radiation Council, 1/30 of the 168-hour-week values for other radioactive substances specified in the National Bureau of Standards Handbook 69.

II. SPECIFIC STANDARDS ESTABLISHED BY THE STATE OF COLORADO:

CLASS B-2 - The following standards shall apply to waters classified for fish and wildlife (Warm Water Fishery):

a. Bacteria: Wastes or substances from controllable sources shall not be discharged into these waters in amounts which will cause the number of organisms of the fecal coliform group, as determined by either multiple tube fermentation or membrane filter techniques, to exceed a log mean of 1000 per 100 milliliters or exceed 2000 per 100 milliliters in more than 10 percent of the samples collected in any 30-day period.

b. Dissolved Oxygen: In warm water fisheries, dissolved oxygen content shall in no case go below 5 milligrams per liter.

c. pH: pH shall be maintained between 6.5 and 8.5. No controllable pH change will be permitted which will interfere with fish and aquatic life.

d. Turbidity: No turbidity shall exist in concentrations that will impair natural and developed fisheries.

e. Temperature: In warm water fisheries the temperatures shall not exceed 90°F. No controllable temperature change will be permitted which will interfere with spawning and other aspects of fish life.

Limits on temperature change have not been established due to lack of historical temperature data and lack of conclusive temperature change criteria for the aquatic biota of waters of the state.

An abrupt change in temperature must be avoided and the normal pattern of diurnal and seasonal changes must be preserved. The maximum allowable temperature increase due to waste discharges in streams will be 5°F.

f. Toxic Material: Free from biocides, toxic, or other deleterious substances attributable to municipal, domestic, or industrial wastes, or other controllable sources in levels, concentrations, or combinations sufficient to be harmful to aquatic life.

g. Other Material: Free from materials attributable to municipal, domestic, or industrial wastes, or other controllable sources that will produce off-flavor in the flesh of fish.

CLASS C - The following standards shall apply to waters classified for industrial uses:

a. Dissolved Oxygen: Dissolved oxygen content shall not go below 3 milligrams per liter.

b. pH: pH shall be maintained between 5.0 and 9.0.

c. Turbidity: No turbidity shall exist in concentrations that will interfere with established levels of treatment.

d. Temperature: The temperature shall not exceed 90°F.

CLASS D-1 - The following standards shall apply to waters classified for irrigation:

a. Total Dissolved Solids (Salt) Concentration: A time-weighted monthly mean at a monitoring station which exceeds the time-weighted monthly mean for a base period established by the Commission by more than two standard deviations shall be subject to review by the Commission.

b. Sodium Adsorption Ratio: A time-weighted monthly mean at a monitoring station which exceeds the time-weighted monthly mean for a base period established by the Commission by more than two standard deviations shall be subject to review by the Commission.

c. Toxic Material: Free from biocides, toxic, or other deleterious substances attributable to municipal, domestic, industrial wastes, or other controllable sources in concentrations or combinations which are harmful to crop life.

APPENDIX B

NEBRASKA WATER QUALITY STANDARDS FOR PROTECTION OF CLASS "C" WATERS

NEBRASKA WATER QUALITY STANDARDS FOR PROTECTION OF CLASS "C" WATERS.

Temperature -

Trout Waters - Allowable change 5°F (maximum limit 65°F).

Warm Waters - Allowable change 5°F, May-October; 10°F, November-April; maximum limit 90°F; maximum rate of change limited to 2° per hour.

pH -

The hydrogen ion concentration expressed as pH shall be maintained between 6.5 and 9.0, with a maximum total change of 1.0 pH unit from the value in the receiving stream.

Dissolved Oxygen -

Shall not be lower than 5 mg/l in warm waters and 6 mg/l in trout waters.

Bacteria -

Coliform group and fecal coliform organisms shall not exceed a geometric mean of 10,000 total coliform organisms or 2,000 fecal coliform organisms per 100 ml. No more than 20 percent of the samples shall exceed 20,000 total or 4,000 fecal coliform bacteria.

APPENDIX C

WATER QUALITY OBJECTIVES RECOMMENDED TO THE CONFERENCE AS A RESULT OF STUDIES CONDUCTED BY THE SOUTH PLATTE RIVER [illegible] PROJECT

WATER QUALITY OBJECTIVES RECOMMENDED TO THE CONFERENCE AS A RESULT OF STUDIES CONDUCTED BY THE SOUTH PLATTE RIVER BASIN PROJECT.

1. In the main stem of the South Platte River from just below the discharge from the Great Western Sugar Company mill in the City of Brighton to the Colorado-Nebraska State Line:

   a. Dissolved Oxygen (DO) content be maintained at not less than 4 mg/l.

   b. The 5-day 20°C BOD level not be allowed to exceed 15 mg/l.

   c. The total and fecal coliform levels not be allowed to exceed 5,000 and 1,000 bacteria per 100 ml, respectively.

2. The Sugar Beet Industry provide treatment of wastes so that the total 5-day BOD load discharged any given day in the total effluents entering basin streams or waterways shall not exceed the given value. Residual wastes could be discharged over an extended period of the year if necessary. The limit set for the Ovid plant was 2,800 pounds of BOD per day.

3. There be no settleable solids contained in the total effluents and that suspended solids loads in these effluents not exceed the numerical level prescribed above for the 5-day BOD.

4. Disinfection be provided for each waste discharge so that the receiving stream or waterway directly below each mill shall not show an increase of more than 5,000 total coliform bacteria per 100 ml and 1,000 fecal coliform bacteria per 100 ml over the corresponding densities upstream of the mill discharge.

5. Dissolved oxygen in the treated waste effluent shall not be less than 2 mg/l at any time to insure minimum dissolved oxygen concentrations of 4 mg/l in the receiving streams or waterways.

6. There be absence of grease, oil, floating solids, slime or sludge banks in the receiving streams or waterways as the result of waste discharges from the sugar beet mill.

7. There be no disagreeable odors or other nuisances in the areas outside of and immediately adjacent to the plant sites.

8. The waste abatement measures given above for the sugar beet industry in the South Platte River Basin shall be completed by September 30, 1968, to provide full capacity for total plant wastes in the 1968-69 campaign and all subsequent campaigns.